PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Applicant	: James A. Folta	Attorney Docket	: CIL-10514
Serial No.	: 09/615,281	Art Unit	: 2125
Filed	: July 13, 2000	Examiner	: S. Garland
For	: A Dynamic Mask For Producing Uniform Or Graded-Thickness Thin Films		

BRIEF ON APPEAL

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V. SUMMARY OF INVENTION

The present invention enables deposition of highly uniform or graded-thickness thin single layer or multilayer films. The method utilizes a moving shaper or dynamic mask which blocks some of the flux from a sputter target or evaporation source before it deposits on the substrate. The acceleration, velocity and position of the mask are computer controlled to precisely tailor the film thickness distribution. The moving or dynamic mask can have a variety of shapes, from a simple solid paddle shape to a larger mask with a shaped hole through which the flux passes. The invention is applicable to any type of vapor deposition system, but is most useful for ion beam sputter deposition and electron beam evaporation deposition. It enables a high degree of uniformity for ion beam deposition, even for near-normal incidence of deposition species, which may be critical for producing low-defect multilayer coatings for masks for extreme ultraviolet (EUV) lithography. This method is an extension of the technique for improving uniformity for magnetron sputter systems described and claimed in copending U.S. Patent No. 6,524,449, wherein the substrate is translated across stationary flux sources. The present invention applies to deposition systems in which the substrate is not translated (although it may still be spun or tilted to improve the thickness profile); instead a moving mask is translated between the source and the substrate to achieve the desired thickness profile. Also, the dynamic mask of the present invention is more effective and significantly simpler in operation than the two shutters that are moved in mutually perpendicular directions in front of the substrate,

as disclosed in Bruijn et al. The method of the present invention enables thin film uniformity to 0.1% over a 6-inch substrate, for example.

VI. ISSUES

Whether claims 1, 3-6, 8-17, 19 and 20 are unpatentable over Bruijn et al.

Whether claim 18 is unpatentable over Bruijn et al. in view of the prior art of figures 2A and 2B and their descriptions

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page 10, line 19 through page 11, line 3, controlling mask acceleration is a means for compensating for source flux distribution.

Further, the Examiner states: "It would have been obvious to one of ordinary skill in the art to modify Bruijn to have the computer control the acceleration and velocity of mask so that it can be accurately positioned and also prevent damage to the mask and/or actuators." There is no teaching or suggestion within the reference to make this modification. Rather, the reference indicates that it is successful in producing graded thickness films and ungraded thickness films using the teachings therein. See section 4 on page 919 and section 5 on page 920. Thus, the reference does not suggest that any modification is necessary.

As discussed in MPEP § 2143.01, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify or combine reference teachings. The Federal Circuit has produced a number of decisions overturning obviousness rejections due to a lack of suggestion in the prior art of the desirability of combining references, as discussed in the aforementioned section.

The Examiner states: "Further it would have been obvious to one of ordinary skill in the art to modify Bruijn to control the deposition using the mask so that the most uniform layer with the smallest tolerance can be formed, since this is the ultimate goal in forming a uniform layer". Again, there is no teaching or suggestion within the reference to make this modification. Rather, the reference

indicates that it is successful in producing the desired films using the teachings therein. Thus, the reference does not suggest the modification.

Claims 1, 11 and 19 all include the limitation of using a computer to control the acceleration and velocity of the mask. Claim 7 has been canceled. Claim 10 depends from claim 1. Claim 16 depends from claim 11. Claim 20 depends from claim 19. Therefore the rejection should be withdrawn.

Is claim 18 unpatentable over Bruijn et al. in view of the prior art of figures 2A and 2B and their descriptions?

Claim 18 depends from claim 11, which should be allowable as discussed above. Therefore the rejection should be withdrawn.

Further, there is no discussion of controlling mask acceleration in Bruijn et al. or in figures 2A and 2B and their descriptions in the present application. Therefore the rejection should be withdrawn.

Accordingly it is submitted that the rejections of Claims 1, 3-6 and 8-20 as being unpatentable are improper and should be reversed.

Respectfully submitted,

John P. Wooldridge

John P. Wooldridge
Attorney for Appellants
Registration No. 38,725
Tel. No. (808) 875-0012

Dated: December 30, 2004

IX APPENDIX I

1. In a method for the vapor deposition of thin single layer or multilayer films on a substrate, the improvement comprising:

positioning a computer controlled dynamic mask adjacent said substrate to block a portion of deposition material directed toward said substrate,

moving said mask relative to said substrate, and

controlling acceleration, velocity, and position of said dynamic mask by said computer to precisely tailor film thickness distribution.

3. The improvement of Claim 1, wherein moving said mask is carried out to enable one or more of linear or rotational movement of said mask.

4. The improvement of Claim 1, wherein said dynamic mask is selected from the group consisting of a solid mask, and a mask with a shaped hole therein.

5. The improvement of Claim 4, wherein said shaped hole in said dynamic mask is selected from the group consisting of circular, rectangular, and complex shapes optimized for uniformity and deposition rate.

6. The improvement of Claim 1, wherein moving said mask is carried out to enable movement of said mask relative to said substrate selected from at least one of linear movement, rotational movement, single pass, multiple pass, partial pass, and complete pass.

8. The improvement of Claim 1, additionally including providing said computer with software capable of moving said dynamic mask so as to form a film on said substrate, wherein said film is selected from the group consisting of uniform thickness films and graded thickness films.

9. The method of Claim 1 wherein the vapor deposition of thin films on a substrate is carried out by using a deposition source selected from the group consisting of ion beam sputter source, electron-beam evaporation sources, ion-assisted ion beam sputter sources, and ion-assisted electron-beam evaporation sources, and wherein said dynamic mask is moved so to produce a precisely tailored film with either uniform thickness or graded thickness.

10. The method of Claim 9, wherein the film is produced to have a uniform thickness to about 0.1% across the substrate.

11. In a vapor deposition apparatus, the improvement comprising:

a movable mask mounted in front of a substrate to be coated with a film of selected material,

said movable mask being selected from a group of masks consisting of solid masks and masks having a shaped hole therein through which deposition material passes to the substrate, and

means for moving said movable mask relative to said substrate being controlled by a computer, wherein said computer controls acceleration, velocity, and position of said dynamic mask to precisely tailor film thickness distribution.

12. The improvement of Claim 11, additionally including software for said computer to cause motion of said movable mask to allow deposition material to form a film on the substrate selected from one of uniform thickness and graded thickness.

13. The improvement of Claim 11, wherein said movable mask has a shaped hole therein, and wherein said shaped hole is configured to optimize uniformity and deposition rate.

14. The improvement of Claim 11, wherein said movable mask is controlled by software in said computer to move in a linear motion or a rotational motion.

15. The improvement of Claim 11, wherein said movable mask is controlled by software in said computer to make single or multiple passes in front of said substrate per layer of material deposited on said substrate.

16. The improvement of Claim 11, wherein said computer includes software which controls the acceleration, velocity and position of said movable mask to precisely tailor film thickness distribution.

17. The vapor deposition apparatus of Claim 11, selected from the group consisting of ion beam sputtered sources and electron-beam evaporation sources.

18. The vapor deposition apparatus of Claim 17, additionally including an ion source producing an ion beam directed at said substrate.

19. A method for producing single layer or multilayer films with high thickness uniformity or custom thickness gradients, comprising:

providing a vapor deposition source,

providing a substrate in spaced relation to said source,

providing a computer controlled dynamic mask in front of the substrate to block an amount of flux from the source before it deposits on the substrate, and

controlling acceleration, velocity and position of the dynamic mask by the computer to precisely tailor the film thickness distribution.

20. The method of Claim 19, additionally forming the vapor deposition source from a deposition system selected from the group consisting of ion beam sputter systems, electron-beam evaporation systems, and ion beam assisted sputter or evaporation systems.

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IX APPENDIX I

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moving said mask relative to said substrate, and

controlling acceleration, velocity, and position of said dynamic mask by said computer to precisely tailor film thickness distribution.

3. The improvement of Claim 1, wherein moving said mask is carried out to enable one or more of linear or rotational movement of said mask.

4. The improvement of Claim 1, wherein said dynamic mask is selected from the group consisting of a solid mask, and a mask with a shaped hole therein.

5. The improvement of Claim 4, wherein said shaped hole in said dynamic mask is selected from the group consisting of circular, rectangular, and complex shapes optimized for uniformity and deposition rate.

6. The improvement of Claim 1, wherein moving said mask is carried out to enable movement of said mask relative to said substrate selected from at least one of linear movement, rotational movement, single pass, multiple pass, partial pass, and complete pass.

8. The improvement of Claim 1, additionally including providing said computer with software capable of moving said dynamic mask so as to form a film on said substrate, wherein said film is selected from the group consisting of uniform thickness films and graded thickness films.

9. The method of Claim 1 wherein the vapor deposition of thin films on a substrate is carried out by using a deposition source selected from the group consisting of ion beam sputter source, electron-beam evaporation sources, ion-assisted ion beam sputter sources, and ion-assisted electron-beam evaporation sources, and wherein said dynamic mask is moved so to produce a precisely tailored film with either uniform thickness or graded thickness.

10. The method of Claim 9, wherein the film is produced to have a uniform thickness to about 0.1% across the substrate.

11. In a vapor deposition apparatus, the improvement comprising:

a movable mask mounted in front of a substrate to be coated with a film of selected material,

said movable mask being selected from a group of masks consisting of solid masks and masks having a shaped hole therein through which deposition material passes to the substrate, and

means for moving said movable mask relative to said substrate being controlled by a computer, wherein said computer controls acceleration, velocity, and position of said dynamic mask to precisely tailor film thickness distribution.

12. The improvement of Claim 11, additionally including software for said computer to cause motion of said movable mask to allow deposition material to form a film on the substrate selected from one of uniform thickness and graded thickness.

13. The improvement of Claim 11, wherein said movable mask has a shaped hole therein, and wherein said shaped hole is configured to optimize uniformity and deposition rate.

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17. The vapor deposition apparatus of Claim 11, selected from the group consisting of ion beam sputtered sources and electron-beam evaporation sources.

18. The vapor deposition apparatus of Claim 17, additionally including an ion source producing an ion beam directed at said substrate.

19. A method for producing single layer or multilayer films with high thickness uniformity or custom thickness gradients, comprising:

providing a vapor deposition source,

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providing a computer controlled dynamic mask in front of the substrate to block an amount of flux from the source before it deposits on the substrate, and

controlling acceleration, velocity and position of the dynamic mask by the computer to precisely tailor the film thickness distribution.

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FEE AUTHORIZATION FOR FILING A BRIEF IN SUPPORT OF APPEAL UNDER 37 CFR 1.17(c)

The fee required for filing a Brief in support of an appeal is $500.

The Commissioner is hereby authorized to deduct the required fee ($500) from Deposit Account 501913.

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